

OFFICIAL BUSINESS

NVS

NATURAL VALLEY STORAGE: a partnership with nature

Public Information Fact Sheet
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U.S. Army Corps of Engineers New England Division 424 Trapelo Road Waltham, Massachusetts 02154

THE WATERSHED STORY

The Charles River Watershed, covering an area of 307 square miles, is the most densely-populated river basin in New England. The lower portion of the watershed drains into a 9-mile impoundment known as the Basin and is the population center of the Commonwealth. It is understandable then that the residents and the properties of the lower Charles are the most seriously affected when flooding occurs. In 1955 Hurricane Diane swept through the watershed and left behind her flood damages of \$5.5 million, the most ever recorded.

None of the actions contemplated by state or local authorities seemed up to the task of preventing a recurrence, and in 1965 the House of Representatives' Committee on Public Works adopted a resolution calling on the U.S. Army Corps of Engineers to conduct a review of "... the Charles River Basin and tributaries, Massachusetts, with a view to determining the advisability of improvements in the interest of flood control, navigation, tidal flood control, allied purposes and related resources."

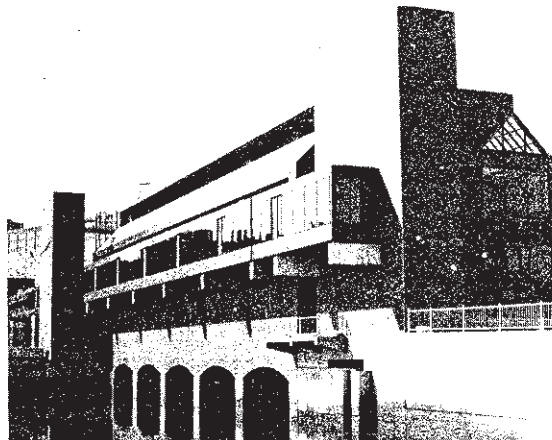
To help meet the Congressional mandate for a comprehensive study of this 307-square-mile watershed, the Corps of Engineers as lead agency set up a Coordinating Committee of Federal and state interests. A Citizens Advisory Committee (CAC) was formed to represent the variety of Charles River interests. The CAC was a close working partner of the Coordinating Committee throughout the 5-year study.

Because the Charles River behaves like two separate hydrologic entities it is amenable to two distinct but coordinated methods of flood control. The non-structural Natural Valley Storage (NVS) program of wetlands acquisition and preservation is at work in the middle and upper watershed, and a new dam and pumping station is ready to take over the problem of the lower watershed.

None of the 20 dams on the Charles River was designed for flood control. Most were small mill dams. The farthest downstream dam was built in 1910 between Boston and Cambridge to interrupt the tidal flow which at low tide exposed odorous mud flats. (The relationship between direct sewage discharges and the history of malaria was not made until later and it was considered sufficient to cover the flats with a constant pool.) Because the flooding problem in the lower river was serious, the Corps issued an interim report in 1968 recommending the immediate construction of a proper flood control facility across the mouth of the river. The existing dam cannot cope with the high river

flows of a storm, particularly when they coincide with high Boston Harbor tides when gravity sluicing is impossible. Neither the space nor the geological conditions at the existing dam could accommodate the addition of the large pumping station needed to discharge river flows against high harbor tides. Another site about a half mile downstream was chosen for a more effective facility. Congress authorized its construction in August 1968, barely 3 months after the recommendation had been submitted. That degree of acceptance has been the hallmark of the entire Charles River experience.

Several years' preparation was necessary before the actual structure could be started. Decrepit pilings remained from busier commercial times at the mouth of the Charles and had to be cleared. Thousands of cubic yards of muck was barged away for proper disposal. The supports of the old Warren Avenue crossing were carted away. By the time the area was tidied up and ready for a face change it was 1974 and, on June 17th, the 199th anniversary of the founding of the Corps of Engineers, the ceremonial spades broke ground.



In addition to the Corps' interim report, 1968 also saw the appearance of another major area storm, which provided a natural test laboratory for the Corps to try out a growing conviction about the rest of the watershed. While the damages from the 1955 Hurricane Diane were severe in the Basin drainage area, they were relatively minor upstream. That pattern of losses great and small was repeated in March 1968. In that storm, 5 inches of rain fell on a watershed already soaked and snow covered. Melted snow and new storm water ran rapidly over the paved lower watershed and within a couple of hours was at the dam demanding to be let out. Discharge through the gravity sluices was impossible, and there were no pumps. The back-up flooded roads, basements, and the subway. There was simply no place for it to go until the next low tide. All of the river's natural safety valves had been wiped out by development.

Upriver meanwhile the engineers working on the Charles River project were able to record the flood crest in one community, get a night's sleep marked only by the excitement of what they were

witnessing, and pick up the flood crest the following day only slightly downstream of where they had left it. From here the flood crest took 4 to 5 days to reach Watertown Dam (river mile 10) and slip into the Basin which by then had room for it. The management system upstream was a natural one, with thousands of acres of unconnected wetlands in the tributaries of the Charles playing a relay game of "I'm soaked — it's your turn" and passing the flood gradually downstream. The Charles River watershed is naturally blessed with an abundance of wetlands — swamps, bogs, wet meadows, and marshes. Their vital role in flood management was not widely understood generations ago when many of them were eliminated as supposed waste lands in favor of fill and development. However, as more and more of the so-called mistakes of nature were "improved" the damage from uncontrolled floods had been increasing. The Corps found the future threatening for this watershed under pressure. Protection of that marvelous control system would be cheaper, more efficient, and environmentally sounder than any new dams. Indeed during the course of the study there had been a search for suitable impoundment sites but none could be found that could store as much storm water as the wetlands were storing and certainly none was as attractive environmentally. In April 1972 the Corps recommended the acquisition and permanent protection of 17 scattered wetlands comprising about 8500 acres.

The track record established for the new dam has been matched by the program for the old wetlands. The life of a typical Corps of Engineers flood control project is about 18 years from initiation of study, through authorization by the Congress, engineering design, and finally construction. Study was initiated in 1965, the Charles River Dam was authorized in 1968, preparatory work began in 1972, ground was broken in 1974; workers and weather struck only briefly and the flood control feature of the project was completed in 1978. This has been a short 13 years.

In the case of NVS, which grew out of the same study, the recommendation was made in 1972, it was authorized by Congress in the Water Resources Development Act of 1974 (PL93-251), and acquisition began in June 1977. When the Office of Management & Budget showed reluctance to involve the Federal government in such a large-scale land purchase for flood control, Massachusetts Senator Edward M. Kennedy filed legislation to move it along. Strongly supported by the Massachusetts delegation and a generally encouraging House and Senate, the NVS program moved through Congress in a single session. Despite the need to negotiate individually with several hundred land owners, NVS is expected to be completed by 1981.

Both the dam and the wetlands program have been applauded by a knowledgeable and interested public. The Corps developed an enviable record for open planning. Via the Citizens Advisory Committee participation and a series of informational meetings and many mailings, the public was well informed about both projects. Not surprisingly, neither of them met any significant opposition at their first public appearance. And in discharging its obligation under the National Environmental Policy Act to cite the impacts of the projects on the natural environment, the Corps was able to state that very little of the natural environment remained in the lower Charles so no adverse impacts were anticipated there, while the NVS program would of itself preserve the environment that fortunately still remained largely unspoiled in the rest of the watershed. The dichotomy that is the Charles was once again underscored.

Progress on both projects has truly been remarkable. Authorizations came rapidly on the heels of recommendations. Appropriations have kept up with the work schedules. Indeed Nature has cooperated by sending light snow when it would enhance important wetlands aerial photography and withheld heavy rain until the pumps in the new dam had just completed testing.

There is a third element in this Partnership with Nature. While the dam is passing downstream storm waters and the major wetlands are sitting on upstream storm waters, there are many miles of main stem and tributary flood plains that must also be kept available for natural flooding. The language of PL93-251 requires that the Commonwealth of Massachusetts assure the United States Government that the state will do its part. These assurances were signed by Governor Michael S. Dukakis in March 1977 and companion legislation was adopted on behalf of the Water Resources Commission in December 1977. Watershed residents will be secure from future flood damages only if all three parts of the basinwide program are intact — the dam, the NVS wetlands, and the flood plains. Long vision demands containment of the short-sighted temptation to nibble. With the continued cooperation and coordination that has characterized the Charles River program to date it is likely that the Partnership with Nature will be a success story indefinitely.

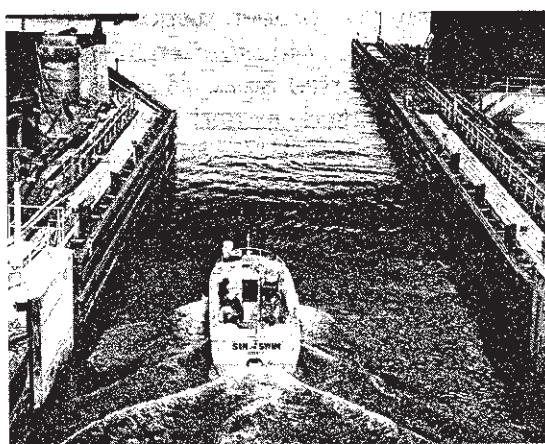
THE DAM

Take a coastal plain river system richly endowed with tidal marshes and a huge inner bay. Give it a place in history and fill the watershed with creative and energetic people. Bring in, in due course, a stream of railroad cars with gravel to fill in the bay — it becomes The Back Bay, a choice bit of real estate for residential, commercial, and academic development. Tidy up the marshes with more fill so that they too can support institutions and people. Then in 1910 erect a dam across the river to impede the tides and impound the little river on its final 9-mile trip to

Boston Harbor. Build embankments and low parkways and high buildings and many parking lots for thousands of resident and commuter cars. Urbanize the watershed. Thwart the river.

Rain falls and under natural conditions a good deal of it will seep into the ground and move slowly by gravity to the nearest body of water. Pave the watershed to any great degree and the non-percolating rainfall will run over the pavement to that same body of water. The critical factor is the rapidity with which the surface drainage beats out the groundwater movement. About 58 square miles of the Charles River's total 307 square miles of drainage is tributary to the impoundment known locally as the Charles River Basin. It has produced the most people and the most pavement in the watershed.

Because the existing Charles River Dam discharges the river flow to Boston Harbor through gravity sluices that can only operate at low tide, there is no dependable means of discharging flood flows. But flood-producing storms are often attended by high tides, so the dam which seals out the sea now seals in these flood waters. The Basin waters run into any escape they can find. Increased development has meant bigger damages from smaller storms. Clearly the time has come for a proper flood control dam.



(The recurring phrases "existing dam" and "new dam" call for an explanation — there will not be two Charles River Dams per se. When the dam at Boston becomes fully operational — including its navigation locks — the present dam will retire from active service. Its lock and sluices will be left open. The structure itself cannot be removed since it is the foundation for both Craigie Bridge and the Museum of Science. When one dam takes on the function the other will assume a passive role and no longer in fact be a dam.)

May 24, 1978 = a big day on the Charles — the dedication of the new \$47 million dam. The facility includes six massive pumps, three boat locks, a fish passage, and a station for MDC police patrolling both Basin and harbor. There will be a park at either end, the one in Charlestown at the site of Paul Revere's landing. Pedestrians can cross the dam at lock level and watch the boats navigate their locks and the fish navigate theirs. A second-level half-crossing extends from the north shore to the control center where operating personnel will be.

The pumps were tested in December 1977 and worked well. That was fortunate, for on January 26-27, 1978 heavy rains fell and required the operation of three of the pumps to maintain a safe Basin level. Each of the three dis-

charged 630,000 gallons per minute of river flow to the harbor. Flood damages begin when the Basin level reaches 110.2 (MDC datum), and the Corps has calculated that without the pumping the level would have reached within 2 feet of the 1955 record height of 112.5. Thus damages of \$1.13 million were averted. When the Great Blizzard of 1978 arrived only days later, leaving between 2 and 3 feet of snow in the area, it was comforting to know that adequate flood control procedures were now in place and capable to meet the worst eventualities, such as a rapid thaw combined with warm rains.

While \$47 million is a lot of money for a big dam on a small river, the ancillary benefits from companion programs and opportunities are incalculable. The MDC has several water quality improvement projects under way, each timed to the operation of the dam and each triggered to some extent by its construction. Miles and miles of unidentified and inaccessible storm and sewer pipes run under Boston and sufficient cross connections are known to have been made over the past 200 years to create a drainage nightmare. Many though not all of the combined storm and sanitary overflows are being collected by an interceptor sewer under construction for transport to a new chlorination/detention center now being built between the two dams.

Another MDC project is destratification of the two-layer Basin which is part fresh and part saline. A so-so environment does not support either healthy fresh water or healthy salt water biota and a stratified Basin is a major pollution issue. There have been three major avenues for salt water to enter the Basin in addition to the great slug that was introduced during the drought in the 1960s when the Basin level was routinely manipulated to accommodate storms that passed over without depositing rain. In those instances the sea water was introduced to regain a safe level required for utility operations. One obvious means of entry is the lock in the dam. With each locking of even a single small boat there is enough exchange of water between river and harbor to have built up considerable volume with no means of egress. A second entry point has been broken or missing tide gates on the harbor side which were designed to open with the outflow of drainage and slam shut against high tides. Without the gates in good condition the tide waters would rush through up into the system and discharge directly into the Basin. A third entry point was in the leaky sluice gates of the dam itself where very severe storm tides would send the sea water into the river. To some extent each of these avenues is being closed and the MDC is now attempting to deal with the salt water level that has accumulated over the years. Five diffusers will pump air into the bottom waters to enable them to mix vertically and flow out through the active sluices which draw only from the top waters in the river. Late winter is the ideal time when fish are not migrating, when boating activity has not resumed, and when the chlorides and sulfides are at their lowest because of higher winter river flows and no boat lockings to speak of. Winter 1977-1978 was harsh, with

the river under ice for considerable periods. Nevertheless the first stages of destratification got under way in May 1978 and results from the operation of two of the diffusers have been encouraging. The remaining three diffusers will only be test-run in 1978 and fully operational in 1979.

Anadromous fish runs up the Charles are a matter of history, and now only the alewife and a small smelt run make the annual pilgrimage up the river to spawn. Shad were plentiful until dams and pollution discouraged them. Programs are currently under way by the MDC to provide fish passage over all of the Charles River dams under its jurisdiction; the Division of Water Pollution Control and MDC are jointly trying to improve the water quality of the river; and the Division of Marine Fisheries has been attempting to restore the shad run. Several years of egg transplants from the Connecticut River were unsuccessful because of either poor water quality or hungry resident fish. In 1978 the Commonwealth is introducing shad youngsters directly into the Charles from a hatchery in the hope that with the Charles imprint they will eventually return to spawn. In the meantime, the welcome mat is impressive. The fish ladder in the new dam has an attraction flow acceptable to shad, resting pools for the arduous climb from harbor to Basin, and alternative passage designed to take advantage of gravity flow when it is available to save the energy required for a pumped flow. A viewing platform will permit the fish and the people to observe one another. The design of the fish ladder was the subject of a rousing controversy over several years until the Federal and state marine fisheries biologists and the engineers from the Corps reached an accord.

Commercial barging up the Charles has certainly diminished but it has not disappeared altogether. Fuel barges still make deliveries to public and private utilities and will use the large 300-foot lock. Two 200-foot locks will relieve the traffic jams that occur at the present lock each summer weekend as boaters try to get in and out through the single lock at the same time. Each lock can operate one way when need be, making the locking more efficient, saving time, and keeping the salt water intrusion under control.

An additional 30 acres of Basin will be created with the impoundment by the new dam of a half mile of river, and water quality projects planned or now under way will improve the quality of the extended Basin in due course. At the same time an additional half mile of river bank on either shore is the target of MDC plans to extend the Charles River park system between the two dams. The lands are currently in a mix of ownerships and a variety of unattractive uses and it will take at least the \$5-million bond issue now before the Great and General Court to swap the ugly duckling for a park swan. However, the goal has been set and work will start on planning, acquisition, and creation if all goes well. This is a splendid opportunity to increase the open space and recreational amenities of these densely-populated communities at either end of the dam.

THE WETLANDS

(So much interest has been generated by the Natural Valley Storage program since it went public in 1971 that it is hard to believe that anyone interested in watershed management has not heard of it. The full story is told in detail in two prior public information tabloids issued in Spring 1976 and Spring 1977 under the common heading "Natural Valley Storage: A Partnership with Nature." Both are available on request.)

NVS has gone from proposal to project in the remarkably short time that also characterized the dam. The difference has been that a dam cannot function until it is finished while the wetlands have been working all along regardless who is in charge. It is their immediate protection in the context of rapid urbanization of the watershed that justifies the Federal interest.

NVS Area G is the largest (2340 acres) and because of its location the most critical of the wetlands. It comprises approximately 256 individually-owned parcels. Each ownership is a separate transaction, requiring an individual title search, an individual appraisal, and an individual negotiation, so even as things go smoothly they move slowly. Between



June 1977 and March 1978 these carefully-conducted transactions have resulted in the acquisition of 73 wetland parcels totaling about 415 acres. (Total NVS is 8500 acres.) In addition, seven restrictive easements have been negotiated with owners who prefer to retain title to their lands but who have agreed to accept the restraints on the use of the property contained in the easement. Such easements protect and preserve the lands permanently. As long as the Federal interest in natural flood control is assured, the Corps is content.

While Area G is under way, work proceeds as well on the three other wetlands in the first priority group — H, K, and L. These represent an aggregate of about 1600 acres and with Area G comprise almost half of the total area. The real estate arm of the Corps hopes to complete acquisition of a substantial portion of this first priority group within 1978 and has the funds to accomplish that ambitious objective.

Area K is within the property of the Massachusetts Correctional Institution (Norfolk and Walpole State Prisons) and at the present time the Department of Corrections has not decided whether fee title or restrictive easement would better suit its needs. The Commonwealth through other agencies also owns several small and scattered parcels of land in Area G as well as a larger parcel that is part of a new Charles River Med-

field State Park. Easements seem in order for the park land. Already the Corps' maps are taking on the colors of lands bought or easements obtained, but it will be some time before a clear pattern of Federal ownership emerges.

A traditional flood control project defines the real estate role much more clearly than does NVS. A reservoir is after all essentially a single entity in a single location with easily-defined catchment boundaries. NVS is all over the watershed, as are the owners! Add to the built-in complications a certain amount of decision-making by more than 500 individual land owners about whether to sell the fee interest or negotiate an easement and it is easy to see why the process is a slow and costly one. Every inquiry is carefully answered, every concern thoroughly addressed. Real estate personnel realize that the prospect of Uncle Sam at the back fence may worry some people and every effort is made to assure them of the implications of the Federal presence. The extra dedication to personal contacts notwithstanding, NED Real Estate Chief Morris S. Phillips and staff have been commended by the Chief of Engineers' office in Washington for the excellent progress they have made based on a survey of property owners involved.

One uncontrollable slow-down was occasioned by the region's Great Blizzard of February 1978. Massachusetts was in a state of emergency for almost a week and of course no one however dedicated was allowed to go about his business unless it was emergency-related. Subsequently many Corps people were detoured from NVS to manage contracts for snow removal for the cities and towns and the Commonwealth itself. Nevertheless while the Corps was temporarily distracted it was comforting to know that the swamps were still there ready for work. Snow melt was gradual in the spring of 1978, another blessing for the Charles.

With adequate money to spend in a relatively short time, the Corps staff has expanded with the assistance of a variety of contract services. Two surveyor firms are phasing out their work and five new ones are entering the picture. Eight appraisal contracts have been awarded and two more title evidence contracts will soon be signed. NVS has been keeping the real estate community busy. Each piece of land must have a clear title. Those with clouded titles cannot be acquired directly and are subject to eminent domain proceedings. When the land is appraised an appraisal reviewer looks over the documents to be certain that nothing is neglected. Land values are estimated on the basis of established law and fair market value is offered to each individual land owner. If a land owner prefers not to sell, a restrictive easement may be substituted. Condemnation is permitted by Federal procedures in a case of unresolved disagreements, but the Corps has found remarkable acceptance for NVS and it is mostly a matter of options.

At three points during the acquisition procedure the Corps has sent a questionnaire to land owners to inquire about the nature of relationships between owners and Corps personnel and their contract representatives. Questions relate to the

degree of courtesy extended, the thoroughness of the explanation of the acquisition process, whether NVS was satisfactorily explained, and generally whether it has been a positive experience for the owner. This interesting exercise, which is now standard Corps procedure, elicited a 75 percent response and of that about 99 percent was positive. The sensitivity of the approach appears to match the sensitivity of the program design.

Charles River Watershed residents have been learning to accept wetlands values since the mid-1960s when the Commonwealth passed its first wetlands protection statute. NVS is confirming as it moves steadily into reality that wetlands protection offers the public a great many benefits beyond the critical one of flood control. Wetlands contribute to stream flow in dry weather periods, wetlands help to recharge groundwater, wetlands absorb nutrients from run-off, and wetlands provide habitat for wildlife and open space buffers for people. Surely many hapless flood victims across the country must feel a certain envy at the splendid provisions for the Charles made by nature and its partner, in this instance the New England Division, Corps of Engineers.

THE PEOPLE

Since the Charles has often been described by its watershed association as a people's river, it is fitting that the people of the watershed have a strong voice in managing the Federally-acquired NVS areas. The Corps has encouraged this public interest in a program whose recreational benefits were and are an integral part of its attractiveness. Most watershed communities have been defining their open space and recreation needs and some of those needs can be met by careful stewardship of the NVS wetlands. Fishing, hunting, boating, swimming,

walking, picnicking, birding, and just-looking-thank-you are pet pastimes of watershed residents.

The Corps contracted with the Metropolitan Area Planning Council, the regional planning agency whose jurisdiction encompasses the watershed, to set up a representative committee of local officials and interested citizens. The committee membership was asked to state preferences for use and management policies and to suggest how local programs and Corps lands might co-exist. The committee met several times between August 1977 and January 1978 and has recently submitted its report to the Corps. The report urges close cooperation among Federal, state, and local interests on NVS uses. Those lands acquired by the Corps will be public and considerable pressure may be exerted to over-plan them. One leading member of the Citizens Advisory Committee has pleaded for under-planning.

Interest was high in the U.S. Fish & Wildlife Service being designated manager of the public NVS lands, but it does not appear that a sufficiently large contiguous tract will emerge to tempt the Service. Rather, as the committee deliberated, it became clear that the Massachusetts Division of Fisheries & Wildlife would be a logical management agency and the Division has affirmed its interest.

The MAPC committee has recommended several policy directions. Recreational uses should be developed with the concurrence of the various host municipalities. Lands leased back from the Corps should continue in their NVS-compatible uses. Decisions on access to leased lands should be made after consultation with state, local, and private interests. An advisory committee should convene annually to review and evaluate Corps management policies and their effectiveness.

Some time in 1979 the Corps of Engineers will start to develop its formal management policies, taking these local pref-

erences into consideration. As new lands enter the public trust, they will be subject to those articulated policies. Paramount in any management scheme will be a high level of public recreational benefit consistent with NVS objectives of keeping the lands in their natural state for natural flood control. Regional coordination will be necessary to avoid duplication of even minimal facilities by contiguous towns that would result in a pattern of over-development. The watershed cannot afford wall-to-wall canoe ramps, swimming beaches, and picnic grounds. The watershed does need wall-to-wall wetlands intact.

The 3 largest NVS Areas (B, G, and S) are on the main stem of the Charles River; the other 14 are tucked away up in the tributaries. Many already provide recreation for residents. Under Commonwealth wildlife management, wherever hunting is prohibited by local by-law that by-law will be respected. The Massachusetts Division of Fisheries & Wildlife has an excellent management reputation. Decisions on access for recreational vehicles will likely depend on the local preferences and the specific wetland's fragility, though not necessarily in that order.

Lands over which a restrictive easement has been negotiated will continue to be managed by the land owners and public access will be at the discretion of the owners. Two major land trusts — the Massachusetts Audubon Society and The Trustees of Reservations — own NVS lands and already open them to the public. This is expected to continue.

The degree of open planning for NVS management is every bit as important to the Corps as the open planning during the earlier study. Further public participation is encouraged informally — the Corps' Waltham office is on Trapelo Road, a two-way street. Corps personnel have shown themselves amenable to getting and giving advice and information.



Colonel John P. Chandler, Division Engineer for New England, and Arthur F. Doyle, Project Director for the Charles River and the award for NVS.



Citizens from all over the United States and abroad have applauded the New England Division for its splendid flood control program. The Charles River Watershed Association gave its first Environmental Protection Award to the Corps in 1973 for NVS, and the kudos have continued. It is fitting, in the view of all who care about the program, that the New England Division has been recog-

nized officially in Washington with the presentation of the annual environmental award bestowed by the Chief of Engineers. NED was cited for outstanding achievement in furthering the environmental objectives of the Corps:

- to preserve unique and important ecological, aesthetic, and cultural values of our national heritage;
- to conserve and use wisely the na-

tural resources of our nation for the benefit of present and future generations;

- to enhance, maintain and restore the natural and man-made environment in terms of its productivity, variety, spaciousness, beauty and other measures of quality; and
- to create new opportunities for the American people to use and enjoy their environment.

This is No. 3 in a series of NVS public information fact sheets prepared by Rita Barron for the Charles River Watershed Association, Auburndale, Massachusetts 02166 under contract with the U.S. Army Corps of Engineers New England Division. Purchase Order #DACW-78-M-0111.